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A(electrode having a surface and an interior, the surface or interior having been modified to produce spatial modulations in properties of the second electrode; and

generating an electric field at the interface between the electrolyte solution and the second electrode to form a planar assembly of substantially one layer of particles in a designated area on the second electrode, wherein the designated area is defined by the spatial modulations in properties of the second electrode and the properties of the second electrode are those affecting the local distribution of the electric field at said interface.

16. (New) The method of claim 15, wherein the assembly comprises an array of particles.

17. (New) The method of claim 15, wherein the second electrode comprises a silicon electrode.

18. (New) The method of claim 15, wherein the properties of the second electrode comprise interfacial impedance or surface charge density.

19. (New) The method of claim 15, wherein the spatial modulations of the properties of the second electrode is carried out by modifying the surface or the interior of the second electrode by spatially modulated oxide growth, surface chemical patterning or surface profiling.

20. (New) The method of claim 15, wherein the first electrode and the second electrode each comprises a planar electrode, said first and second electrodes being parallel to another and separated by a gap, with the electrolyte solution containing the particles being located in the gap.

21. (New) The method of claim 15, wherein the property of the second electrode being

A1 Cont

modulated comprises impedance, one or more areas of the surface or the interior of the second electrode being modified to exhibit low impedance, and wherein the planar assembly of particles are located in the areas of low impedance.

22. (New) The method of claim 15, wherein the electric field is generated by applying an AC voltage between the first and the second electrode.

23. (New) The method of claim 15, wherein the particles comprise beads.

24. (New) The method of claim 15, wherein the particles comprise beads, the method further comprising the step of maintaining said beads in the assembly subsequent to the assembly formation.

25. (New) The method of claim 24, wherein the beads are maintained in the assembly by maintaining said electric field, chemically linking said beads onto the second electrode, or physically confining said beads.

26. (New) The method of claim 15, wherein the particles comprise beads, the method further comprising the step of removing said electric field to cause the disassembly of said assembly of beads.

27. (New) An assembly of particles on a substrate prepared by a method comprising the following steps:

providing a first electrode positioned in a first plane, and a second electrode positioned in a second plane different from the first plane, an electrolyte solution located therebetween and a plurality of particles therein, wherein the second electrode comprises a planar electrode having a surface and an interior, the surface or interior having been modified to produce spatial modulations in properties of the second electrode; and

A1 cont

generating an electric field at the interface between the electrolyte solution and the second electrode by applying a voltage between the two electrodes to form a planar assembly of substantially one layer of particles in a designated area on the second electrode, wherein the designated area is defined by the spatial modulations in properties of the second electrode and the properties of the second electrode are those affecting the local distribution of the electric field at said interface.

28. (New) The assembly of particles of claim 27, wherein said assembly comprises an array of particles.

29. (New) The assembly of particles of claim 27, wherein the particles comprise beads having biomolecules attached to their surfaces.

30. (New) The assembly of particles of claim 29, wherein the biomolecules comprise peptides or proteins.

31. (New) The assembly of particles of claim 29, wherein the biomolecules comprise oligonucleotides or nucleic acids.

32. (New) The assembly of claim 29, wherein the biomolecules comprise ligands or receptors.

33. (New) The assembly of claim 29, wherein the beads comprise different types of beads, said bead types being distinguishable by the biomolecules attached thereto, and wherein the beads of each type are further distinguishable by a unique chemical or physical characteristic that identifies said bead type.

34. (New) The assembly of claim 29, wherein the beads comprise different types of beads, said bead types being distinguishable by the biomolecules attached thereto, and

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A1

wherein the assembly comprises subassemblies that are spatially separated from each other, and wherein the location of the subassemblies on the electrode uniquely identifies the types of beads located thercin.

35. (New) A method of detecting the formation of a target-biomolecule complex comprising the following steps:

providing an assembly of beads on a substrate according to claim 29, said beads having biomolecules attached to their surfaces;

contacting said beads with a sample that may contain a target compound such that, if the target is present in said sample, said target interacts with said biomolecules to form a target-biomolecule complex; and

detecting the formation of the target-biomolecule complex.

36. (New) A method of detecting the formation of a target-biomolecule complex comprising the following steps:

providing an assembly of beads according to claim 29, said beads having biomolecules attached to their surfaces, wherein said beads comprise different types of beads, said bead types being distinguishable by the biomolecules attached thereto, and wherein the beads of each type are further distinguishable by a unique chemical or physical characteristic that identifies said bead type;

contacting said beads with a sample that may contain a target compound such that, if the target is present in said sample, said target interacts with said biomolecules to form target-biomolecule complexes;

detecting the formation of the target-biomolecule complexes; and

identifying the biomolecules of the target-biomolecule complexes by means of the unique chemical or physical characteristics of the beads associated with said complcxes.

A1 cont

37. (New) The method of claim 36, wherein said assembly comprises an array of beads.

38. (New) The method of claim 36, wherein the biomolecules comprise ligands or receptors.

39. (New) The method of claim 36, wherein the biomolecules comprise peptides or proteins.

40. (New) The method of claim 36, wherein the biomolecules comprise oligonucleotides or nucleic acids.

41. (New) The method of claim 36, wherein the assembly comprises subassemblies that are spatially separated from each other, and wherein the location of the subassemblies on the electrode uniquely identifies the types of beads located therein.

42. (New) A method of detecting the formation of a target-biomolecule complex, said method using an assembly of beads of claim 29 and comprising the following steps:

providing a first electrode positioned in a first plane, and a second electrode positioned in a second plane different from the first plane, an electrolyte solution located therebetween, and a plurality of beads having biomolecules attached to their surfaces, said beads suspended in an interface between the electrolyte solution and the second electrode, wherein the second electrode comprises a planar electrode having a surface and an interior, the surface or interior having been modified to produce spatial modulations in properties of the second electrode;

introducing into said electrolyte solution a sample that may contain a target compound such that, if the target is present in said sample, it interacts with said biomolecules to form a target-biomolecule complex;

generating an electric field at the interface between the electrolyte solution and the second electrode to form a planar assembly of substantially one layer of beads in a designated area on the second electrode, wherein the designated area is defined by the spatial modulations in